A Review on Face Detection based Attendance System with Temperature Monitoring

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Abstract: The face is the identity of a person. The method to exploit this physical feature have seen a great change since the advent of image processing techniques. The attendance is taken in every school, colleges and library. Traditional approach for attendance is professor calls student name & record attendance. Now a days, Machine Learning has been highly explored for computer vision applications. So, we use the concept of machine learning in Face – recognition for automatic attendance systems. In this project, we perform the face recognition and face detection algorithms, to provide the computer systems the ability of finding and recognizing human faces fast and precisely in images or videos so that the systems can used in giving attendance. Along with the face detection temperature measurement is also done using mlx90614 infrared temperature sensor.

Keywords: Face detection, Attendance system, Temperature monitoring, mlx90614

I.   Introduction:

The technology aims in imparting a tremendous knowledge oriented technical innovations these days. Deep Learning is one among the interesting domain that enables the machine to train itself by providing some datasets as input and provides an appropriate output during testing by applying different learning algorithms. Nowadays Attendance is considered as an important factor for both the student as well as the teacher of an educational organization. With the advancement of the deep learning technology the machine automatically detects the attendance performance of the students and maintains a record of those collected data. In general, the attendance system of the student can be maintained in two different forms namely,

- Manual Attendance System (MAS)
- Automated Attendance System (AAS).

Manual Student Attendance Management system is a process where a teacher concerned with the particular subject need to call the students name and mark the attendance manually. Manual attendance may be considered as a time-consuming process or sometimes it happens for the teacher to miss someone or students may answer multiple times on the absence of their friends. So, the problem arises when we think about the traditional process of taking attendance in the classroom. To solve all these issues we go with Automatic Attendance System(AAS).

Automated Attendance System (AAS) is a process to automatically estimate the presence or the absence of the student in the classroom by using face recognition technology. It is also possible to recognize whether the student is sleeping or awake during the lecture and it can also be implemented in the exam sessions to ensure the presence of the student. The presence of the students can be determined by capturing their faces on to a high-definition monitor video streaming service, so it becomes highly reliable for the machine to understand the presence of all the students in the classroom. The two common Human Face Recognition techniques are,

- Feature-based approach
- Brightness-based approach

The Feature-based approach also known as local face recognition system, used in pointing the key features of the face like eyes, ears, nose, mouth, edges, etc., whereas the brightness-based approach also termed as the global face recognition system, used in recognizing all the parts of the image.

II.   Literature Survey:

Gang Jin et al. (2015) presented liquid identification becomes more and more important in the safety inspection at the subway, airport, and railway. Non-contact liquid security identification is the best way, because it can avoid the contamination of the liquids and the injuries caused by some corrosive and toxic liquids. The paper designed the non-contact Infra-Red thermometer based on the sensor of MLX90614 and the most favored microprocessor STM32F107 for the non-contact liquid security identification

system. Completed the hardware circuit, made the PCB plate, programmed the software with Keil C and debugged by Keil uVision4 MDK V4.22. Then, studied the effects by measuring the temperature differences using bottles with various shapes, materials, sizes and wall thickness at different distances. The system meets the requirements of high reliability, low costs, low power consumption, real time response and the demands of the non-contact liquid security identification system.

Piyush Devikar (2017) proposed face liveness and disguise detection system eliminates the chances of a person to fake his/her identity. The face recognition systems available in the market fail to detect the fake faces shaped using high-end silicone masks and prosthetics. Also, these systems misinterpret face from a physical photograph as a real face. These are the vulnerabilities present in the available systems. This paper presents a simple approach to tackle the glaring vulnerabilities that are present in almost all face recognition systems. This system works on the principle that the surface temperatures of masks are close to ambient temperatures, unlike real faces whose temperatures are higher than ambient ones. This system captures image from the webcam connected to Raspberry Pi and then it is processed by OpenCV to detect the face in the image. The temperature of the face captured by the camera is obtained by IR temperature sensor. If the face is detected in the image and its temperature is more than the threshold value (skin temperature) then face is real otherwise, it is fake.

M. Krišto et al. (2018) proposed the popularity of surveillance systems grows as well as a need for better security systems particularly in a bad lighting conditions or at night. The aim of a security system is to collect as many details as possible to enable a better recognition of persons. In this paper, a comparison of representative thermal face recognition methods will be given, emphasizing their strengths and weaknesses. Then, trends in the development of surveillance and security systems will be outlined such as fusion of visible and thermal images and use of convolutional neural networks. Also, existing challenges of thermal facial recognition and its applications in a real world will be pointed out.

M. Kasiselvanathan et al. (2018) presented Facial Recognition is a technology of biometrics has been used in many areas like security systems, human machine interaction and image processing techniques. The main objective of this paper is to calculate the attendance of students in a easier way. We proposed a system called automated attendance management system that uses face recognition method gives solution to the faculty thereby reducing the burden in taking attendance. The system used to calculate attendance automatically by recognizing the facial dimensions. An efficient face recognition based attendance system has been developed by improving the efficiency of the system and also for the secured attendance. The algorithm used in this system is Eigen Faces. The system is not only detecting the faces but also the distance of the facial characters under varying conditions. The proposed system provides the success rate at face recognition is around 93% to 95% and face identification is 99% and gives better result than the existing methods.

Venkata Kalyan Polamarasetty et al. (2018) presented Daily attendance marking is a common and important activity in schools and colleges for checking the performance of students. Manual Attendance maintaining is difficult process, especially for large group of students. Some automated systems developed to overcome these difficulties, have drawbacks like cost, fake attendance, accuracy, intrusiveness. To overcome these drawbacks, there is need of smart and automated attendance system. Traditional face recognition systems employ methods to identify a face from the given input but the results are not usually accurate and precise as desired. The system described in this we aims to deviate from such traditional systems and introduce a new approach to identify a student using a face recognition system, the generation of a facial Model. This describes the working of the face recognition system that will be deployed as an Automated Attendance System in a classroom environment.

Gonçalo Marques et al. (2019) proposed laboratory and teaching activities with reliable data quality should be provided and guaranteed. The thermal comfort of the students must be ensured in teaching activities. During the laboratory activities, several parameters must be ensured and monitored, and data collection must be stored to ensure the stability of the environment when the test is conducted and at the data collection moment as they influence the quality of the results. Oftentimes, there is the requirement of tracking object temperatures with noncontact but also to measure the ambient temperature for comparison. Infrared temperature sensors provide a non-contact measurement in a quickly and accurately process. This paper presents an Internet of Things (IoT) solution for real-time temperature supervision named iRT. The solution is composed of a hardware prototype for temperature data collection and Web compatibility for data access. The iRT uses an infrared thermometer sensor module which incorporates an MLX90614 and provides object and ambient temperature supervision in real-time. The Web application can be used to access the collected data but also provides the history of the temperature evolution. The results obtained are promising, representing a significant contribution to infrared temperature monitoring systems based on IOT.

Nandhini R et al. (2019) presented automatic face recognition (AFR) technologies have made many improvements in the changing world. Smart Attendance using Real-Time Face Recognition is a real-world solution which comes with day to day activities of handling student attendance system. Face recognition-based attendance system is a process of recognizing the students face for taking attendance by using face biometrics based on high - definition monitor video and other information technology. In my face recognition project, a computer system will be able to find and recognize human faces fast and precisely in images or videos that are being captured through a surveillance camera. Numerous algorithms and techniques have been developed for improving the performance of face recognition but the concept to be implemented here is Deep Learning. It helps in conversion of the frames of the video into images so that the face of the student can be easily recognized for their attendance so that the attendance database can be easily reflected automatically.

Smitha et al. (2020) proposed in this digital era, face recognition system plays a vital role in almost every sector. Face recognition is one of the mostly used biometrics. It can used for security, authentication, identification, and has got many more advantages. Despite of having low accuracy when compared to iris recognition and fingerprint recognition, it is being widely used due to its contactless and non-invasive process. Furthermore, face recognition system can also be used for attendance marking in schools, colleges, offices, etc. This system aims to build a class attendance system which uses the concept of face recognition as existing manual attendance system is time consuming and cumbersome to maintain. And there may be chances of proxy attendance. Thus, the need for this system increases. This system consists of four phases- database creation, face detection, face recognition, attendance updation. Database is created by the images of the students in class. Face detection and recognition is performed using Haar-Cascade classifier and Local Binary Pattern Histogram algorithm respectively. Faces are detected and recognized from live streaming video of the classroom. Attendance will be mailed to the respective faculty at the end of the session.

III.   Proposed System

The task of the proposed system is to capture the face of each student and to store it in the database for their attendance. The face of the student needs to be captured in such a manner that all the feature of the students' face needs to be detected. There is no need for the teacher to manually take attendance in the class because the system records a video and through further processing steps the face is being recognized and the attendance database is updated. This system is developed using python opencv.

OpenCV: OpenCV (Open Source Computer Vision Library) is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez (which was later acquired by Intel). The library is cross-platform and free for use under the open-source BSD license.Python is dynamically typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly, procedural), object-oriented, and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library.[
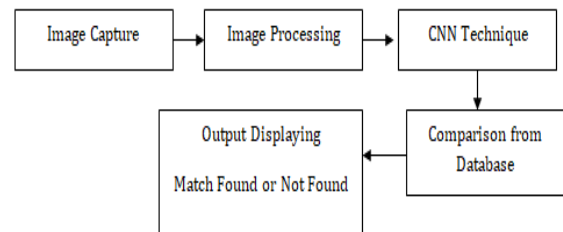

Figure 1: Flowchart of the Proposed System

Image Capture: We need some HD camera in order to get results. We can capture the images from the video stream or by capturing each and every image from the webcam manually. Doing the frame capture from the stream of video will give us results in less time but we won't be able to capture the face properly in case we lose light or something and if the face is not captured properly.

Image Processing: Digital image processing is the use of a digital computer to process digital images through an algorithm. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems. The generation and development of digital image processing are mainly affected by three factors: first, the development of computers; second, the development of mathematics (especially the creation and improvement of discrete mathematics theory); third, the demand for a wide range of applications in environment, agriculture, military, industry and medical science has increased.

Convolution Neural Network: In deep learning, a convolutional neural network (CNN, or ConvNet) is a class of deep neural networks, most commonly applied to analyzing visual imagery. They are also known as shift invariant or space invariant artificial neural networks (SIANN), based on

their shared-weights architecture and translationinvariance characteristics. They have applications in image and video recognition, recommender systems, image classification, medical image analysis, natural language processing, and financial time series. CNNs are regularized versions of multilayer perceptrons. Multilayer perceptrons usually mean fully connected networks, that is, each neuron in one layer is connected to all neurons in the next layer. The "fully-connectedness" of these networks makes them prone to overfitting data. Typical ways of regularization include adding some form of magnitude measurementof weights to the loss function. CNNs take a different approach towards regularization: they take advantage of the hierarchical pattern in data and assemble more complex patterns using smaller and simpler patterns. Therefore, on the scale of connectedness and complexity, CNNs are on the lower extreme.

IV. Conclusion:

Capturing the images from camera or cc camera and applying techniques face detection and recognition can decrease the manual work from human and increase the security safety, taking the decision from this recognition result. Based on this face detection and recognition can used in implement so many application like automatic attendances system based on face recognition, worker attendances, security, safety, police application like finding thief in image that help to catching thief. In this system we have implemented an attendance system for a lecture, section or laboratory by which lecturer or teaching assistant a record student's attendance. It saves time and effort, especially if it is a lecture with huge number of students. This attendance system shows the use of facial recognition techniques for the purpose of student attendance and for the further process this record of student can be used in exam related issues. The temperature is measured using the infrared thermometer is a sensor that consists of a lens to focus the infrared (IR) energy on to a detector, which converts the energy to an electrical signal that can be displayed in units of temperature after being compensated for ambient temperature variation.

Limitations: If the bearded person removes the beard or vice versa it will not be recognized. Also if the face gets highly injured it will not get recognized.

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